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A N  
EXPERIMENTAL ENQUIRY  
CONCERNING THE  
CONTENTS, QUALITIES,  
A N D  
MEDICINAL VIRTUES,  
OF THE TWO  
MINERAL WATERS,

Lately discovered at

BAGNIGGE WELLS,  
Near LONDON;

With Directions for Drinking them, and some Account of  
their Success in obstinate Cases.

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By JOHN BEVIS, M. D.  
Fellow of the Royal Academy of Sciences at Berlin.

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*Siquidem D. O. M. summas et longe præstantissimas in AQUIS recondit  
foterias vires, quarum tanta est excellentia tantaque utilitas ut longe mul-  
tumque omnibus aliis remediorum generibus sint superiores, et, si ex vero  
dicere liceat quod res est, universalior AQUA non detur medicina.  
F. HOFFMANN, De Element. Aquar. Mineral.*

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TO THE  
RIGHT HONOURABLE  
THE  
Earl of MACCLESFIELD  
PRESIDENT,  
AND TO THE  
COUNCIL and FELLOWS  
OF THE  
ROYAL SOCIETY of LONDON,

As most Adequate Judges of the Contents,

This Treatise is

With all Deference inscribed,

By their devoted Servant,

JOHN BEVIS.

THE

AMERICAN

AND

WORLD

OF

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AN  
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CONTENTS, QUALITIES,  
AND  
MEDICINAL VIRTUES OF  
BAGNIGGE WATERS.

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INTRODUCTION.

*Of the Situation, Soil, &c.*

THESE wells are a little way out of London, in the high road from Coppice Row, or Sir John Oldcastle's, which about a quarter of a mile further at Battle Bridge turnpike, comes into the great new road from Paddington to Islington; affording an easy access to the springs for coaches from all parts: And the foot path from Tottenham Court road, by Southampton Row, Red Lion street and the Foundling Hospital, to Islington, Clerkenwell and Old Street, running close by the wells, is

no less convenient for such as prefer walking exercise.

The place where the waters issue, is environed with hills and rising ground every way but to the south, and consequently screened from the inclemency of the more chilling winds. Primrose hill rises westward ; on the north west are the more distant elevations of Hampstead and Highgate ; on the north and north east there is a pretty sudden ascent to Islington and the New river head, and a near prospect of London makes up the rest of the circumference, with the magnificent structure of St. Paul's full in front and nearly upon a level with Bagnigge house. \*

Such a situation, however agreeable in itself, and favourable to the production and maintenance of

\* In some ancient deeds the ground where this house stands is called Bagnigge Vale. On a square stone over an old Gothic portal taken down about three years ago, and now replaced over the door from the high road to the house, is cut the following inscription ;

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S T  
THIS IS BAGNIGGE  
HOUSE NEARE  
THE PINDER A  
WAKEFEILDE  
1680.

Over one of the chimney pieces is the garter of the order of St. George in rais'd work ; and over another, the royal arms on one side, and on the other side the same arms joined with several more. Between them is the bust of a woman in a Roman dress, let deep into a circular cavity of the wall, bordered with festoons of Delf earth in the natural colours and glazed. It is said, to represent Mrs. Eleanor Gwin, a favorite of Charles the second, who some times made this place her summer residence.

springs,



springs, should seem nevertheless to expose their waters to be frequently contaminated and spoiled by inundations from large and sudden rains: And yet that these springs ever suffer the least damage on that account does not appear; since they are found to retain their genuine clearness, mineral flavours and virtues through all seasons and vicissitudes of weather.

The floods, which at times roll down toward this spot, are all received and carried off quick, without ponding, by a rivulet, anciently called the River Fleet, which running near Pancras-church and the Brill, passes under Battle-Bridge, and so on hard by the wells, to London, discharging itself into Fleet-ditch, and at last into the Thames. Add to this, that although it be difficult to dig hereabouts two or three feet deep without encountering springs, yet do the sources of the wells lye so low, as to be inaccessible to any percolations of rain or other waters, from or near the surface.

The neighbouring soil is various, as stiff blue clay, lime stone, brick-makers earth, and, on the north, and north east especially, plenty of red sand, gravel and ochre earth, out of which rise many little ferrugineous springs, of a weak impregnation, scarce to be distinguished as such, but by their variegated film, and the yellow sediment which they deposit in trenches and ditches.

At what time these waters were first known to be possessed of salutary qualities, cannot be made out with any degree of evidence. A tradition goes, that the place of old was called Blessed Mary's Well; but that the name of the Holy Virgin having in some measure fallen into disesteem after the reformation, the title was altered to Black Mary's Well, as it now stands upon Mr. Rocque's map, and then to

Black Mary's Hole ; though there is a very different account of these later appellations : For there are those who insist they were taken from one Mary Woolaston, whose occupation was attending at a well, now covered in, on an opposite eminence, by the foot way from Bagnigge to Islington, to supply the soldiery, encamped in the adjacent fields, with water. But waving such uncertainties, it may be relied on for truth, that the present proprietor upon taking possession of the estate, found two wells thereon both steaned in a workmanlike manner ; but when or for what purpose they were sunk, he is entirely ignorant. The waters of these wells, one of which purges, the other is a chalybeat, are the subjects of the present inquiry ; and the use of the former being frequently directed as preparatory to that of the latter, I shall begin with it.

## P A R T I.

### *Of the Bagnigge Purging Water.*

In the year 1757, upon boiling some of this water in a tea-kettle, it was observed to turn whitish and foul, which caused it to be rejected for culinary uses. The same year a man who attended the working of some snuff mills, then erected close to the well, happening to be feverish and thirsty, drank plentifully of the water, and found himself immoderately purged by it ; which gave the first intimation of its cathartic quality.

The purging well is about two and twenty feet deep. There is not the least appearance of any water trickling in through the junctures of the steaning, but it all arises from the very bottom, and comes in but slowly through a blue clay, as has been found  
by



by exhausting it almost to dryness by continued pumping. What kind of strata lye above the said blue clay, I have not been able to learn.

The water, fresh from the pump, is remarkably clear and limpid, and discharges more air bubbles at the surface, than most waters do at the spring head, tho' far short of the Bagnigge chalybeat water in this respect. It never turns foul or deposits any sediment, or throws up any scum, if kept in clean vessels, unless heated to a degree much beyond that of the warmth of any known climate.

It tastes not disagreeably in the mouth; but being swallowed, leaves a distinguishable brackish bitterness on the palate.

There is nothing remarkable in it as to smell, when cold.

On a cloudy day in August 1759, when Fahrenheit's thermometer hanging in the pump-room stood at 70, I took it down and immersed it successively in the purging water and chalybeat waters, both fresh pumped, as also, in the running water of a neighbouring spring, till it became stationary in each. In the first it stood at 53, in the second at 63, and in the last at 58. Again in September, when the thermometer in the shade stood at 56, in the purging water it was at 50, and in the chalybeat at 59. Also from many other trials I found the instrument always several degrees lower in the purging water than in the chalybeat. November 20th being a hard frost, the thermometer in the open air stood at 28, in the purging water at 40, in the chalybeat at 53, and in the spring at 49; and December 23, thermometer in air shewed 23, in the purging water 41, and in the chalybeat 53.

By a very nice glass hydrometer, equal volumes of distilled water, and of the purging water under  
the

the same degree of heat, weighed respectively 2915 and 2924 grains; whence the specific gravity of distilled water to that of the purging water is as 1 to 1,0031; and very nearly the same proportion came out by the hydrostatical balance.

A half pint glass of the fresh pumped purging water was placed under the receiver of an air pump, and remained there some minutes after the exhaustion of the air: then it was tasted with another fresh glass of the same, and found not to be near so palatable as before, the bitter now manifesting itself far more sensibly.

A bottle of this water, which among several others cork'd and wax'd, the proprietor had ship'd for Virginia in October 1758, came back and was brought to me in October 1759. It was then quite limpid, and without a particle of sediment, nor was the taste sensibly impaired. Three half pints of it had much the same purgative effect, as if fresh from the well.

*Experiments on the purging water, in order to a discovery of its principles and contents.*

#### EXPERIMENT I.

I put two London beer quarts of the fresh water from the pump, into a glass body of a proper capacity, to which was fitted a head and receiver, luted close with starch'd paper, and distilled with a sand heat which barely kept the water simmering. In about three hours the body seemed to be left quite dry with some residuum in the bottom.

When the fire had been extinguished long enough to let the glass body cool, I separated the head,  
and



and carefully took out the residuum, which being a little moist, I thoroughly dried it in a china saucer set on warm embers : It then weighed 135 grains.

The distilled water taken out of the receiver measured the same to all appearance as before the distillation, allowance being made for the bulk of the residuum, the little moisture it retained, and what might probably exhale through the junctures before the paper grew dry ; and it differed not upon any tryal from distilled river water.

Before the water begun to simmer it turned turbid and whitish, and soon a calx was perceptible at the bottom of the glass vessel, which for some time gradually increased, but ceased to do so a good while before the distillation was compleated.

A seemingly calcarious dust also covered the greatest part of the surface, but as soon as the water simmered, it sunk.

## EXPERIMENT II.

In order to obtain a good quantity of the salts of this water, I exhaled eight gallons of it in a well tin'd copper boiler, to the consumption of about two thirds. This was in the month of October 1759, when the weather was uncommonly hot, for the time of year; for the thermometer stood at 70. I took notice, that though I had regulated the fire to a very moderate boiling heat, yet the boiler was lined with a white dust quite to the brim, which made me susp<sup>t</sup> that some of it might escape in the evaporation : Wherefore I took out the remainder, carefully wiping up the subsidence and the white dust from the sides of the vessel with a sponge which I soaked and squeezed out in the warm water. This water I poured by several portions



portions into a thin hemispherical glass vessel, having been the bottom part of a large retort, which I placed on the top of a tin kettle two third parts full of boiling water, so as to finish the exhalation with the gentle heat of a *balneum vaporis*, both to prevent the rising of any of the solid contents, and to secure the residuum from suffering any alteration by being burnt or scorched at last. When the moisture was near evaporated, and the magma began to grow stiff, I was obliged to be continually stirring it with a spoon to hinder it from sticking to the glass, which I found it very apt to do: And as I could not keep my face clear of the ascending fumes, I perceived a strong rank scent towards the latter end, and was presently after seized with a violent head ach; whether from those effluvia, or from my being over heated, which lasted a fortnight, tho' I had ever been almost a stranger to such a disorder.

Upon carefully weighing the dry residuum immediately after it was taken from the fire, I found it 2385 grains, being 298 grains to a gallon, of a yellowish grey colour, little differing in appearance from that of the 1st experiment.

### EXPERIMENT III.

I evaporated a single gallon of the water fresh from the pump, continuing the operation from the beginning to the end, in *balneo vaporis*; and obtained no less than 392 grains of the like dry residuum, as in the former experiment; and in November, after a three days hard frost, I got within a few grains of the same quantity from another gallon.

## EXPERIMENT IV.

Into four ounces of the fresh water I poure a tea spoon full of distilled water wherein ten drops of the syrup of violets had been diluted, and mixed them well with a feather. The mixture exhibited a weak green or aquamarine, which continued the same the next day.

## EXPERIMENT V.

Fifteen grains of good rhubarb in powder infused in the same quantity of the water, gave at first a beautiful clear yellow, which by degrees grew stronger and stronger, and the next day was a deep orange colour.

## EXPERIMENT VI.

With two ounces of the water a few drops of ol. tart. perdeliq. struck an exceeding white cloud; which condensing for a considerable time, at length sunk to the bottom, and lastly assumed the appearance of an earthy powder.

## EXPERIMENT VII.

The same quantity of the water and the like number of drops of spirit of hartshorn produced a thin cloud, also pretty white, which discovered no tendency to precipitation all day, but was the next day found to have subsided.

## EXPERIMENT VIII.

Spirit of salt ammoniac in the like manner gave  
C a white



a white cloud which soon began to sink, and was precipitated in fifteen or twenty minutes.

#### EXPERIMENT IX.

Several drops of a solution of borax in distilled water, when mixed with this water produced no sensible appearance at all.

#### EXPERIMENT X.

Two ounces of the water poured upon half a dram of dry cream of tartar excited no ebullition; but the mixture took a semiopaque white which lasted many hours without settling.

#### EXPERIMENT XI.

Two or three drops of the solution of pure silver in aqua fortis, let fall upon two ounces of the water, instantly struck a thick and exceeding white cloud, which soon precipitated in a curd of the same colour, but in a little while altered to a pink colour at the upper surface, then to a purple, and last of all, after some days, to a very deep purple, almost black.

#### EXPERIMENT XII.

About as many drops of a solution of quicksilver in spirit of nitre struck a thicker cloud than in the last experiment, and of a cream colour; which soon settled to the bottom in a compact curd, and in a few hours took the fine complexion of turpethum minerale, and held it several weeks.



## EXPERIMENT XIII.

A solution of corrosive sublimate in distilled water let fall very gradually into two ounces of the water, went directly to the bottom, without forming the least cloud, turbidness or ebullition, and without any appearance of sediment. The sides and bottom of the glass were lined with numbers of small air-blebs.

## EXPERIMENT XIV.

A solution of sugar of lead in distilled water, produced, with only three drops on two ounces of the water, a white turbidness all over, which began to precipitate slowly in about half an hour, and at last appeared as a white powder.

## EXPERIMENT XV.

A solution of alum in distilled water was very gradually dropt on two ounces of the water as far as twenty drops, before a sensible turbidness was produced; it was no cloud, but rather distinct floating and very minute particles, which in about half an hour subsided in a whitish powder.

## EXPERIMENT XVI.

Strong oil of vitriol was let fall drop by drop on one ounce of the water; it sunk quick to the bottom, and raised up infinite numbers of most minute air-bubbles, but without any notable effervescence, even when a quantity nearly equal to that of the

water had been dropped in. When the ebullition ceased the mixture was perfectly limpid, without the least sediment.

#### EXPERIMENT XVII.

Spirit of marine salt was dropped on in like manner, with much the like success, except that here plenty of whitish fumes arose.

#### EXPERIMENT XVIII.

Three or four drops of an infusion of galls, made by pouring a pint of boiling water on half an ounce of the nuts in powder, produced with six ounces of the purging water but a very slight alteration; by giving it a tinge of its own brown colour, but the next day it was turned of a deep dirty green, and deeper still a day or two after.

#### EXPERIMENT XIX.

Ash bark fresh scraped from a dry stick, after two hours turned the water of a dirty greenish blue.

#### EXPERIMENT XX.

I soaked a pound of raw lean beef in a gallon of the water three days, and then boiled them together three quarters of an hour. The outside of the flesh looked more red than if it had been impregnated with common salt, and the inside was throughout of a deep red.



EXPERIMENT XXI.

The water would not lather, cold or hot, with any soap I could procure, but felt very harsh, and curdled strongly.

EXPERIMENT XXII.

Being boiled with an equal part of new milk, the mixture turned to curds and whey.

*Experiments on the dry residuum of the purging water.*

EXPERIMENT XXIII.

I tasted the yellowish grey sediment left after a gentle exhalation of the purging water of the 3d. experiment, and found it at the tip of my tongue to have a strong relish of common sea salt; but as it dissolved in my mouth, its taste was nauseously bitter, not much unlike that of the artificial Epsom salt of the shops, but more disagreeable.

EXPERIMENT XXIV.

Ten grains of this residuum being left in a watch glass in damp weather began to relent in a few hours, though in a room where there was a fire, and the next morning seemed much dissolved, except the earthy part which subsided.

EXPERIMENT XXV.

Four drops of syrup of violets rubbed in an agate mortar



mortar with ten grains of the residuum, the mixture presently became of a feint green, and continued much the same for eight and forty hours; perhaps this might be from the yellow of which the powder participated.

#### EXPERIMENT XXVI.

I applied a strong artificial magnet to a small portion of the residuum pretty finely powdered; but could not perceive that it attracted even a single particle of it, either before, or after laying on a red hot iron.

#### EXPERIMENT XXVII.

On six grains of the residuum I let fall as many drops of oil of vitriol; which instantly produced a violent conflict; and copious white fumes arose, and continued to do so about a minute; after which I tasted the mixture, and found that the acidity of the oil was almost destroyed.

#### EXPERIMENT XXVIII.

On the same quantity of the residuum as in the last experiment, I poured the like number of drops of ol. tart. per deliq. without producing the least degree of fermentation.

#### EXPERIMENT XXIX.

I boiled three drams or 180 grains of the residuum obtained as in the 3d experiment, in a pint and half of distilled water. When the indissoluble matter was all subsided, I decanted off most of the clear  
water,

water, and put the rest, with the subsidence carefully washed out, into a dry paper filtre which weighed exactly  $11\frac{1}{2}$  grains, and as the water filtered through, I poured on more till about another pint had passed: then I took the filtre out of its funnel, and having carefully dried it, I found it and the contained indissoluble matter to weigh together  $73\frac{1}{2}$  grains. Subtracting  $11\frac{1}{2}$  grains for the weight of the filtre, the remaining 62 grains is the weight of the indissoluble earthy matter; and this taken from 180 grains, the weight of the dry unelixated residuum, leaves 118 grains for the weight of the dissolved salt. Now we have seen from the 3d experiment, that this water, after a very gentle evaporation to dryness, leaves 392 grains of residuum upon a gallon: making then due proportion, it will follow that 257 of those grains are true dissoluble salt, and the other 135 grains an indissoluble earth. And further, supposing a beer gallon of water to weigh  $140\frac{1}{2}$  Troy ounces, or 67440 grains, as by unquestionable experiments it has been found to do very nearly, then it will also follow, that in this experiment, the residuum to the exhaled aqueous part is as 1 to 171, the saline to the aqueous part, as 1 to 261, and the terrene to the same, as 1 to 497.

### EXPERIMENT XXX.

A small parcel of the dry residuum powdered per se and placed on a red hot iron, laid quiet and did not sparkle in the least, nor sent up any sensible smell or fumes, nor was at all attracted by the magnet when cold: and the like quantity mixed with as much powdered charcoal, shewed on the iron no mark of deflagration.

*Experi-*



*Experiments on the indissoluble terrene matter.*

## E X P E R I M E N T XXXI.

The earthy matter left undissolved in the filtre, when perfectly dry, was always of a light grey, felt harsh and sandy, but discovered no gritty-ness between the teeth, nor had it any particular taste.

## E X P E R I M E N T XXXII.

With the strong mineral acids it fermented violently and sent up copious fumes, especially with oil of vitriol; but discovered no commotion at all with alkalis, as ol. tart. per deliq.

## E X P E R I M E N T XXXIII.

Being mixed with syrup of violets, no new colour was produced after several hours, but the next day the mixture shewed a dirty green.

## E X P E R I M E N T XXXIV.

It did not sparkle or swell on the red hot iron, but turned a little paler than before, without sending up any fumes or smell.

## E X P E R I M E N T XXXV.

I put half a dram of this matter into a small crucible covered at top with tobacco pipe clay, leaving a little hole for a spiracle, and kept it half an hour  
red



red hot in a charcoal fire. When it was cool, I took out the matter, and found it united into a porous lump. It had lost ten grains of its weight in the fire, and was whiter than before; tasted acrid and limey, but had little or no smell. In this condition, when powdered, it refused the magnet.

*Experiments on the salt elixated from the residuum.*

### EXPERIMENT XXXVI.

I put half an ounce of the residuum into a filtre, and saved about an ounce of the first running of distilled water poured hot upon it. This ley was very clear, and of a pale yellow. It tasted much like a strong brine of common sea salt, but withal disagreeably bitter.

### EXPERIMENT XXXVII.

When I had evaporated the ley to dryness, in a china saucer, set on a hot iron plate, the remaining solid salt was pretty near of the colour of opaque amber; tasted at first like sea salt, but left an intolerably bitter farewell on my tongue, which lasted an hour, though I washed and gargled my mouth with warm water. It gave nothing of a cool sensation, like nitre, but seemed rather pungent and acrid.

### EXPERIMENT XXXVIII.

It turned syrup of violets of an elegant pale green: however I look upon this but as a dubious proof at best, that the salt is alkaline: for mixtures of blue  
D and

and yellow, 'tis well known, are generally green; and the ley produced no alteration of colour with the syrup. See the 25th. experiment.

### EXPERIMENT XXXIX.

A small piece of beef rubbed over with the salt, after two days redened much in boiling.

### EXPERIMENT XL.

As much as would lay on a sixpence of the salt, being dissolved in a quart of warm soft water, hindered its lathering with good soap, and made a curdly mixture.

### EXPERIMENT XLI.

The same quantity boiled with near a pint of new milk, turned it to a stiff curd and a pretty clear whey.

### EXPERIMENT XLII.

The salt wetted with a solution of corrosive sublimate, sufficient to dissolve part of it, manifested no change of its colour.

### EXPERIMENT XLIII.

Rubbed with an equal quantity of salt of tartar in an agate mortar, it betrayed little or nothing of a urinous scent.

### EXPERIMENT XLIV.

About half a dram of the salt being laid on a



red hot iron, neither crackled nor blistered, but presently melted into water, bubbled, exhaled without any notable scent, and yet left a small matter of a white calx sticking to the iron; which was rather of a maukish acrid than a saline taste. The like quantity mixed in one parcel with its weight of pulverised charcoal, and in another of brimstone, neither deflagrated nor fulminated on the iron.

#### EXPERIMENT XLV.

This salt fermented violently with oil of vitriol, and raised plenty of pungent fumes; with oil of sulphur not so much; with spirit of marine salt but little; and with the weaker acids, as lemon juice and vinegar, scarce at all; nor with alkalis, as ol. tart. and spirit of hartshorn. A solution of alum in distilled water dropt into the ley to a pretty good quantity, neither fermented, clouded, or precipitated any thing for several hours, but the next day the thinnest cloud imaginable might be just discerned in the bottom of the glass. Aqua fortis in which it had been dissolved, readily dissolved leaf gold.

#### EXPERIMENT XLVI.

The salt taken dry from the fire in a china saucer, would always grow damp in cool, though dry air, in a few hours; and in damp weather would in a night's time be for the most part dissolved to a brine: and yet it would not in any time be totally dissolved. This brine differed not in taste from that of common sea salt: but the salt which would not run per deliquium tasted extremely bitter and disagreeable. About ten or twelve times its weight of boiling water poured on the salt when quite dry, wou'd readily dissolve it all.



Many writers on mineral waters speak of obtaining the crystals of their salts as a matter of no great difficulty ; nothing, according to them, being necessary to that end, but exhaling the brine of the residuum till a pellicle is seen on its surface, and then setting it in a cool cellar, for the crystals to shoot. Others however, who seem to have tried various methods, talk of the thing in a very different language. Among these are the laborious Dr. SHORT, and the no less laborious Dr. RUTTY. The former, in his History of Mineral Waters, \* reckons among the desiderata for quickly discovering their impregnating principles, “ the time and manner of expeditiously procuring perfect crystals from the salts of any water.” And the latter has this remark, † “ I made a great many fruitless experiments before I succeeded in the crystallization of salts, and at length found two things commonly necessary to be attended to : 1. that the solution be evaporated very low down : 2. that the crystallization succeeded better in some degree of warmth, than in the cold, even as is known in sugar candy ; and accordingly Dr. SHORT found, that the salts of mineral waters shot better in the summer months than in the winter.” I shall cite one more, because he is justly celebrated for his uncommon knowledge in practical chemistry and mineralogy, Dr. DIEDERICK WESSEL LINDEN. § The chief article we want in our present experiments, is an immediate precipitation of the salts from their watery vehicle ; that is to say,

\* Pag. 316 of the first edition.

† Methodical Synopsis of mineral waters. Preface pag. 12.

§ A treatise on the three mineral waters at Llandrindod in Radnorshire, pag. 138.

“ to precipitate the salt out of its solvent, as silver  
 “ is precipitated out of aqua fortis, by the help of  
 “ common salt or copper. Whenever we attain to  
 “ this art, we then shall have these salts in their  
 “ utmost perfection. . . . That there is such a thing in  
 “ nature seems to be indicated in several instances :  
 “ for example, sea water will extract the salt out  
 “ of salted flesh. A particular sort of clay will  
 “ suck up all salt, and make salt water pure, if  
 “ filtered or strained through it. Even rock salt it  
 “ self is a natural precipitation, caused by a glebe  
 “ or stratum of this particular clay. . . . Why should  
 “ we not attain to this useful secret, if we did but  
 “ apply ourselves to it ?”

For my part, I must own, that after I had obtained a good quantity of salts from both these Bagnigge waters, I was long frustrated in every attempt to make them put on the appearance of crystals, and even began to despair of seeing them in distinct and specific forms : but happening to look into a very entertaining as well as useful book, called Employment for the Microscope, written by Mr. Henry Baker, F. R. S. I there met with a most ingenious and elegant way of speedily forming and exhibiting to view the crystals of salt floating in any pellucid solvent : but as this requires a microscope of a particular construction, of which I was not provided, and besides, some dexterity in managing the experiment, I had recourse to the worthy author, taking with me a small vial of the brine of either salt. This gentleman, I am proud thus publicly and gratefully to acknowledge it, received me with all the candour and politeness imaginable, immediately set up his microscope, and gave me the satisfaction I had so much wished for. As to the method of conducting this curious experiment, I refer



I refer my reader to the VII. chapter of the book itself, and shall here only describe the forms of the crystals which I saw in a single drop of the brine of the purging water, spread on a transparent glass plane, placed under the microscope, after it had been a little warmed by passing it a few times backwards and forwards over the flame of a candle.

As the heat first took effect on the thinnest part of the drop about the verge, the exhalation was quickest there, and there it was that the scene of crystalization began, in the following manner.

Little stems without number arose, as it were insensibly (for it was impossible for the eye to seize them at their very origin) out of the liquid condensed by the evaporation of some of its aqueous part near the edge, as from a bank or bed; and, by the like insensible degrees, from these shot out lateral ramifications, and others also from them: so that after some time they did not ill resemble multitudes of fern plants with their branches and leaves. But observe that by my expressing my self thus in a sort of botanic language, I would not be understood to conceive any thing in these phenomena as analogous to vegetation, but certain configurations, as my author properly calls them, of saline crystals, resembling the appearance of other things of a very different nature, by a certain apposition of innumerable figures, all similar to one another, or nearly so. For when these component or elementary forms, if I may so call them, were strictly and distinctly viewed, they might be perceived to be in a manner all of them flat prisms with triangular bases, not at right angles, but slanting to their sides, such being the specific form the crystals of that particular salt did then, and at all times does assume: for salts, as the great Sir ISAAC NEWTON sug-



suggests, being in a great measure indestructible in their nature, their shapes are also constant and invariable.

Upon shifting the glass so that a part of this little briny ocean remote from the shore came in sight, the appearance was greatly altered: for now every where were seen little six-sided figures infinite in number, if I may say so, in respect of the numberless prisms before spoken of; some of these perfect cubes, others consisting of two equal and rhombal faces with four equal square sides; some so very minute as hardly to be distinguished at first from points, but sensibly increasing their bulk whilst they were looked at. There was yet another sort, being four-sided flatish pyramids with a narrow rhombal base; but these were fewest of all. In some places many of one or more sorts were joined in contact, and lay in clusters or groupes; and wherever this happened they were hardly any of them perfect in their figure.

Thus agreeably was I entertained for an hour or more: but this rather increased than abated my impatience of falling to work again, in hopes of getting crystals of far ampler dimensions than those I had seen, the largest being scarce  $\frac{1}{400}$  of an inch long; and after a while, by a due attention to Dr. RUTTY's hints, and others I chanced to furnish my self with from a very curious paper in the Parisian Memoires \*, and a world of tryals, I at last gained my end, but not without making use of a great quantity of ley at a time, so that it will be hardly worth my while to go into a detail of my experiments, or my readers to repeat them af-

\* For the year 1745, entitled, *Sur la cristallisation du sel marin*, par M. ROUELLE.

ter me : however, let me observe that the crystals were of the forms already described, and of no others, as far as I could perceive.

I have said, experiment 2d. that when the magma began to stiffen after the evaporation was almost compleated, it was very apt to stick fast to the vessel. This I found to be from a clamminess in the salt which it would never part with whilst over the fire ; but as soon as taken off it might for a little while be kneaded like dough, without adhering to the fingers, and in a few minutes, by growing cooler would harden, and might then be easily pulverised. This clammy part, somewhat analogous to heated alum, would dissolve in water, and pass the filtre with the rest, and might be seen after some days standing still, in the form of a cloud at the bottom of the ley. This substance I suspected to be a great impediment to the shooting of the crystals of this water's salt ; for the chalybeat's salt has less of it. At last I bethought myself of a probable means, either of dissolving or disengaging it ; with which therefore I will conclude my experiments on the purging water.

#### EXPERIMENT XLVII.

Into a clear cylindrical glass which held about three ounces of the ley of a moderate strength, soon after it had passed the filtre, and before any cloudiness had subsided, I dropped four drops of solution of salt of tartar, made with just as much water as would entirely dissolve it at once ; which diffused itself in a light coloured cloudiness all over the ley, and did not seem to sink much before it grew dark. The next morning I found it was all got to the bottom, and condensed there in a kind of



out so much as gueſſing it had been given to theſe ſprings. Mr. HUGHES took me to his wells, where I was not a little pleaſed with the elegant accommodations he had provided for company, in ſo ſhort a time. Upon intimating his deſire, that I would proceed to compleat a proper ſeries of experiments on the waters, and draw up ſome rational account of them, I conſented to do ſo; the reſult of all which is the little treatiſe now humbly ſubmitted to the public.

The chalybeat well is juſt behind the pump room, about forty yards ſouth of the purging well, being almoſt twenty feet deep, and near two yards in diameter within the ſteaning. It is fed by no leſs than four ſprings drilling thro' the ſteaning, the ſtrongeſt and pureſt of which is one that runs in plentifully from the north. It has been found upon exhausting this well, that it replenishes at the rate of three feet in an hour.

The water freſh pumped up, is exceeding clear, and much of the complexion of pure rain water; has ſomething of a ſulphury ſmell as it iſſues out, and diſcharges great quantities of air bubbles at the ſurface. Its taſte is highly ferrugineous, with an agreeable and ſprightly ſubacid tartneſs.

To thoſe that have not been uſed to it, it is apt to communicate a kind of giddineſs with an amazing flow of ſpirits, and afterward a propenſity to ſleep, if exerciſe be not interpoſed.

Being left open to the air it will in an hour or leſs turn a little wheyiſh and abate of its clearneſs, eſpecially in warm weather; and perhaps in a day or two begin to let fall an ochrey ſediment: this is common to all chalybeat waters.



If it stands quiet in an open vessel, a shining scaly dust spontaneously emerges and covers the surface; but if disturbed, it sinks to the bottom and there lies undissolved, with the ochrey sediment, and will rise no more. This substance upon examination proves to be selenite.

I have observed already, page 5, that the thermometer in this water always stands 10 or 12 degrees higher than in the purging water; whence I think I may infer, that it is possessed of a thermal warmth, probably from the mutual action of its iron and sulphur upon each other; I shall bring some proofs that this is the case.

By the hydrometer, the specific gravity of distilled water to that of this chalybeat, under the same temperature, comes out as 1 to 1,0042.

It retains its mineral virtue to a most amazing degree, in all seasons and climates; and in clean bottles well corked and waxed, will bear carriage, not only to any part of Great Britain, and Ireland, but even beyond sea, as far as the West Indies, and back again; of which more hereafter.

*Experiments on the Chalybeat Water, in order to a discovery of its principles and contents.*

#### EXPERIMENT I.

Two drops of tincture of galls, made by pouring a pint of pure rain water boiling hot on half an ounce of the nuts in powder, let fall into half a pint of the fresh chalybeat, formed a little brownish cloud without the least redness, near the surface, which gradually sunk with a curling motion, turned by degrees to a rich transparent and deep purple, and tinged the whole body of the water of the same colour, which lasted without any sensible change several days.

Ex-

## EXPERIMENT II.

The like quantity of the chalybeat placed in the receiver of an air pump, as soon as the pump was worked, parted with innumerable air bubbles, and continued to do so for above 300 strokes of the piston. When the gauge shewed the pump to have been well exhausted, the water was taken out, and found to taste dead and vapid, but struck the purple with the galls as readily and fully as before, and retained it as long. The experiment with galls was repeated with water, that had been kept in the exhausted receiver four days, with the like success.

## EXPERIMENT III.

Mr. HUGHES fetched a bottle of the chalybeat, which had remained uncorked in the pump room above a week ; a glass of it tinged with the galls as readily, as if fresh from the pump. Another bottle that had been kept corked, under water, five months did the same.

## EXPERIMENT IV.

I ordered an eight gallon jarr, whose mouth was about 9 inches diameter, to be filled with the chalybeat, and set in the pump room uncovered, in order to promote the separation and subsiding of its ochre, which I was willing to collect in a good quantity for making experiments upon it. This was in August 1759. At the end of three weeks, the weather continuing pretty warm, the water was poured out and smelt very fetid, yet was clear and tasted sweet, sprightly, and strong of iron : wherefore being desirous of trying the effect of the gall tincture, I poured a single drop into a glass of it, and was surprised



prised to see that it presently gave the purple as deep or rather deeper than when fresh from the fountain. I then proceeded to examine the contents of the bottom of the jarr; and contrary to my expectation found there less sediment than is often met with from a single quart of the same water after a few days standing. What grout I could collect I poured into a bottle, with as much of the water as filled it. This I sent home carelessly corked, having first slip'd a silver groat into it to try if it would be discoloured. Two days after I found that the water was got quite clear, and I could perceive the groat among the sediment, tinged of a dusky yellow. I poured out a glass of the water, which still stank but tasted sweet, and again struck with a drop of the tincture a fine pink colour, which in a minute turned of a deep purple; thus I went on day after day entertaining myself and my friends with this uncommon phenomenon, till my bottle was exhausted.

A little reflection made me conclude, that all this might be the effect of a certain power in the water, of resorbing, redissolving, and once more intimately reuniting with its deposited ochre and iron, by a sulphury gas which I plainly smelt, so as to recover its martial taste and virtue, together with the imaginary tinging principle, or volatile fugacious spirit, so generally supposed to escape even glass with ease, and not to be renewed. Should this be the case, thought I, why may not the same power support it through a long voyage? and I proposed to Mr. HUGHES to send a stone bottle of the chalybeat by sea to Bristol, to be brought back by the same ship. He answered, that he believed my curiosity might be otherwise soon satisfied, for that he had the last year sent some bottles with the like intention to Virginia, and expected the return of them in a short time.



## EXPERIMENT V.

In October Mr. HUGHES came to let me know the bottles were come back, which he had sent just a year before; and the next day one of each sort was brought me. I have before, page 6th, spoken of the condition in which I found the purging water. We opened the chalybeat and tasted it: I cannot say that it had preserved its full flavour; yet it tinged well with the galls, which it did also, tho' not so readily, a day or two after, when the bottle had been left but in part full.

## EXPERIMENT VI.

Among the histories of chalybeat waters we frequently find a very small degree of heat above that we understand by temperate, will soon deprive most of them of the faculty of striking purple with galls, which has been commonly ascribed to the escape ethereal principle or mineral spirit, as it is called, in which the said faculty, and all their medicinal virtues are held to consist. Some indeed are said to retain them more powerfully, as that of Pyrmont; and among other English waters the Malton spaw, which will bear transporting with its virtues entire, says Dr. RUTTY, to foreign parts. I was willing to satisfy myself by experiment, which heat this chalybeat would endure before it gave over tinging; I therefore set a tin quart pot full of it, together with a small FAHRENHEIT's thermometer, upon charcoal embers. When the quicksilver had got up to 96, the term of animal heat, I poured out a glass, which had all the genuine flavour, tasted very agreeably, and struck the purple as well as when cold: it did it as well too, I thought, at 112, and 120; but at 130 it began to let fall its ochre,

ochre, and tinged but slowly and faintly ; at 135 it gave no colour at all.

### EXPERIMENT VII.

The reverend Dr. HALES \* is of opinion, that  
 “ that the strength and goodness of a chalybeat can-  
 “ not be judged altogether by the deepness of its  
 “ tincture with galls, as some have imagined ; and  
 “ that it seems reasonable, in order to judge of the  
 “ comparative strength of chalybeats, not only to  
 “ compare the different strength of their tinctures,  
 “ but also their respective quantity of residuums, and  
 “ how much of a mineral acid, as oil of sulphur, is  
 “ required to take away their tinging quality.” Thus  
 Bath water ceased to tinge with four drops to a pint,  
 Bramshot with three, and Sunning-hill with a single  
 drop. I tried the effect of the same acid on Bagnigge  
 chalybeat : with five drops to a pint I perceived no  
 alteration ; with ten not much ; with twenty the galls  
 gave a fine pink colour, which grew more and more  
 dilute as I increased the number of acid drops in each  
 pint glass of the water, but was not entirely extinct  
 with fifty drops ; and the addition of a drop or  
 two of oil of tartar would presently again produce the  
 deep purple.

### EXPERIMENT VIII.

To the mouth of a two quart bottle just filled with  
 the chalybeat brought fresh from the pump, we fixed  
 a small suction syringe with its piston thrust down  
 close to the bottom ; which, as soon as we had made  
 all secure with a good cement, we drew up to the top,

\* Account of some experiments and observations on chalybeat  
 waters, pag. 145.



and so left it for about two hours, to receive the air and the elastic spirit, if any, that might extricate itself from the water ; then we closed the turn-cock at the neck to prevent any thing from escaping from within, and having taken off the syringe we instantly immersed its snout into a small basin of rain water, with which a tea spoonful of tincture of galls had been mixt, opened the stop-cock and forced out the air into the water, which immediately emerged in bubbles at the surface : but as for a tinging spirit, we could discern no tokens of any such thing, for the water continued as colourless as before.

The foregoing experiment was tried in consequence of one said to have been made by Dr. TAVERNER on the Witham spaw, which I carefully repeated with this chalybeat, but without any success. Dr. RUTTY calls it a curious one, and recites it thus :\*

“ Two Florence flasks were filled, one with the  
 “ spaw fresh taken up, the other with common wa-  
 “ ter in which was a strong infusion of galls, and by  
 “ means of a siphon a communication was maintain-  
 “ ed between both : the mouths of both were ac-  
 “ curately closed with a cement that would prevent  
 “ the most subtile vapour from escaping. Where-  
 “ upon the mineral spirit passing through the siphon  
 “ did tinge the water with purplish streaks.”

*Quere.* Might not that leg of the syphon which was immersed in the common water, have been, by some unheeded accident, wetted with the chalybeat, or the moist vapour of it ?

#### EXPERIMENT IX.

The chalybeat, when evaporated in balneo vaporis, always left a small matter more of dry residuum in

\* Synopsis, pag. 385.



summer than in winter, which was of a deep yellow approaching to an orange colour, with a few glittering particles interspersed. A gallon left upon a medium 243 grains, 125 of which upon filtration with distilled water, proved to be dissoluble salt ; the rest an ochrey earth with a small portion of selenite.

#### EXPERIMENT X.

The chalybeat with syrup of violets turned of a light weak green, which in a little time faded quite away. With the same syrup diluted in water no colour was produced.

#### EXPERIMENT XI.

With powdered rhuburb it first took a brown, afterwards a purple brown.

#### EXPERIMENT XII.

A pound of beef soaked three days and then boiled in it, was a little redened, but far less than with the purging water.

#### EXPERIMENT XIII.

Ol. tart. sunk quick and formed a smooth white sediment : spirit of hartshorn gave a semi-transparent whiteness, slow in subsiding ; spirit of salt ammoniac did much the same.

#### EXPERIMENT XIV.

A solution of borax in water, struck a very faint white cloudiness which vanished without precipitating : A solution of alum gave an equally diffused pearliness or opaline for a considerable time, which at the end of  
three

three hours settled in an uniform sediment without curdling, and the next day had the appearance of a fine light-coloured powder.

#### EXPERIMENT XV.

An aqueous solution of sugar of lead instantly struck a very thick and snow-white turbidness which did not begin to sink for some time, but at last subsided in a kind of white cloud, which gradually took the appearance of a subtile powder of the same colour, but very small in quantity.

#### EXPERIMENT XVI.

Two drops of a saturated solution of cupelled silver in aqua fortis, let fall upon three ounces of the chalybeat, instantly generated a pearly cloud, which in diffusing itself inclined to a pink colour, settled down purple, and the next day was dyed on its top surface of a very deep and dark purple, which held the same many weeks. The like solution of quicksilver produced as suddenly a cream-coloured cloud, from whence fell, first a yellow precipitate paler than turpethum minérale, and then upon that a white one, both permanent for several days.

#### EXPERIMENT XVII.

A few drops of concentrated oil of vitriol excited a quick ebullition and effervescence with one ounce of the chalybeat, and the instillation being continued till the quantity of the acid was almost equal to that of the water, the mixture became so hot that it broke the glass to pieces. The like experiment being made with strong spirit of marine salt, a sudden ebullition ensued and a cloud of pungent white fumes ascended,

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but



but the effervescence was scarce sensible. Oil of sulphur, the elixir acidum and lemon juice, likewise raised some ebullition, but not a great deal.

### EXPERIMENT XVIII.

This water curdled with soap, but in a far less degree than the purging water, and scarce at all with hot milk.

*Experiments on the residuum of the chalybeat water.*

### EXPERIMENT XIX.

It tasted at first like that of the purging water, that is of sea salt ; afterwards bitterish, but not so disagreeable as the other. Nor did the same quantity of it curdle so much with soap, nor redden flesh as that did. It relented much slower in the same moist air, and not half so much of it was dissolved in any space of time.

### EXPERIMENT XX.

When rubbed with syrup of violets it gave a faint yellow green, if the mixture was spread on white paper ; any pulverable substance of so deep a yellow 'tis like would have produced such a colour.

### EXPERIMENT XXI.

It dispersed no curious scent when triturated either with salt ammoniac, or salt of tartar.

## EXPERIMENT XXII.

The strong mineral acids excited a violent commotion with the residuum, and raised plentiful white fumes. Alkali's did not seem to operate upon it.

## EXPERIMENT XXIII.

I could not find any particle of the residuum to leap or adhere to the magnet. When laid on a red hot iron it neither smoaked, sparkled nor blistered, but crackled a little, and turned or curled up at the edges: the under part next the iron was changed to a tawney red, and many particles of that colour were attracted by the magnet. Another parcel mixt with powdered charcoal was laid on, which also crackled faintly, but without any deflagration.

*Experiments on the indissoluble matter.*

## EXPERIMENT XXIV.

The indissoluble matter left in the filtre when dried, was of a light brick colour with a shade of the orange; tasteless and not gritty, yet of not so subtile particles as the earthy matter of the purging water; it fermented and fumed much with the strong acids, which dissolved a great part of it, but lay quiet with alkali's.

## EXPERIMENT XXV.

Having been rubbed with syrup of violets no new colour was produced till the next day, when the mixture was changed to a brown bordering upon green.



## EXPERIMENT XXVI.

It laid quite still on the hot iron, and turned of a brown like Spanish snuff. Half a dram of it roasted half an hour in a crucible in a clear charcoal fire lost  $12\frac{1}{2}$  grains of its weight, and looked of a tawney flesh colour. It had when taken from the fire a strong sulphurine limey taste, and seemed to burn my tongue ; I had afterwards several sulphury belches, probably from swallowing my spittle. The hot limey taste vanished from it entirely in a few days, though it retained the sulphury flavour. When thus roasted, the magnet would attract it as readily as the filings of iron.

*Experiments on the elixated salt.*

## EXPERIMENT XXVII.

The salt was of an orange colour, and tasted like sea salt with a bitterish farewell, but not so bitter or ill relished by a great deal as the purgative salt. It imbibed the moisture of the air, yet not quite so much as the other ; and required five or six times its weight of water to dissolve it intirely, being dry.

## EXPERIMENT XXVIII.

The strong mineral acids excited a violent commotion and fumes with it ; alkali's none at all. It smelt no ways urinous rubbed with salt of tartar ; nor altered its colour with an aqueous solution of sublimate.

## EXPERIMENT XXIX.

It turned syrup of violets greenish; so did its strong brine : but it should be noted that both were of a deep yellow colour.

## EXPERIMENT XXX.

Lean beef powdered with it two days and then boiled, had but a slight cast of red.

## EXPERIMENT XXXI.

Half a dram of it dissolved in a quart of warm water, rendered it very reluctant to lather with soap. The like quantity turned new milk a little grumous.

## EXPERIMENT XXXII.

In the preparation of the Prussian blue it is generally held that the iron contained in the vitriol is the basis of the fine colour produced : and I having some suspicion that the deep yellow colour of this salt was owing to a subtilely attenuated iron that passed the filtre along with it, employed it as a succedaneum to the vitriol, in the process; and thereby obtained a blue pigment, but very pale and inelegant.

## EXPERIMENT XXXIII.

The crystals formed in a drop of the strong brine of this salt placed under the microscope had none of those branchy configurations described in pag. 22, nor could I perceive a double pyramidal crystal, or one with opposite rhombal faces among them : and whether seen by the microscope, or by the bare eye  
when



when made to shoot by means of the salt of tartar, they were all either cubes or flat triangular prisms; yet certainly the number of the prismatic ones was very small in comparison of what the other salt afforded; and the cubes on the contrary seemed to be multiplied.

*Observations on the experiments.*

Without going into a particular comment upon each experiment, it will appear by comparing this set with the former, that though these two waters differ widely as to some of their respective principles and component parts, yet they agree pretty well in others, proportions only excepted: and no wonder, considering their fountains happen to be situated so near together.

The water, regarded as pure and elemental, must be the same in both; so in all probability is the elastic air they contain; each holds a muriatic and a bitter purgative neutral salt, each an alkaline absorbent or lime-stone earth.

But the water we have at present under consideration, appears from many circumstances to be also richly impregnated with a chalybeat principle, most exquisitely refined and elaborated by nature, and adapted to penetrate the minutest vessels and recesses of the human frame, and thereby correct, reform, invigorate and confirm the constitution.

To prove what we assert, let us compare it with the most celebrated of all chalybeats, the Pyrmont water. That it is said strikes a deep purple with galls, bears carriage well, and will tinge at a year old: we have proved that this does the same, see experiment 5th. Dr. HALEs conjectures that the goodness of a chalybeat may be judged of from the quantity of its re-

siduum,

fiduum, and is apt to think that the excellency of the Pyrmont lies chiefly in that. Dr. RUTTY is of the same mind, and sets down in his synoptic table the quantity to be 145 grains upon a gallon ; to the Pouhon only 40 ; and among 69 more English and Irish chalybeats, there is but one whose residuum exceeds 40 grains upon a gallon. Turn to our 9th experiment, and it will appear, that the Bagnigge chalybeat leaves no less than 243 grains on a medium, almost twice as much as the Pyrmont ; half of which is an earth, rich in a most subtilely attenuated iron. How long the Pyrmont will retain its flavour, virtue, and tinging faculty in open jars, bottles, or in vacuo, or what degree of heat it will endure before it ceases to tinge or begins to drop its ochre, has not been made appear that I know of ; all which the reader may be satisfied about, as to the Bagnigge water, by reading our 2d, 3d, 4th, and 6th experiments.\*

That

\* Since this was written, I was informed, in February 1760, of the arrival of a fresh parcel of Pyrmont water, taken up in season, of which I procured a large bottle, warranted to be well corked and waxed, as indeed it appeared to me to be. It was opened in Mr. HUGHES's pump-room, in the presence of three persons who were proper judges, when I noted down the following particulars.

1. Being poured into a glass it sparkled little more than the Bagnigge chalybeat did from a bottle that had been kept five months.

2. It shewed no purple with tincture of galls, even with ten drops to half a pint, but only a pale pink colour which deepened not on standing ; but the like quantity of the Bagnigge water five months old presently turned of a deep purple with a single drop.

3. To my palate it plainly tasted of the vitriolic acid, and the rest of the company thought so too ; I therefore drop'd a single drop of ol. tart. per deliq. into the glass with the tincture of galls to correct the acidity, and the whole, upon stirring it, instantly changed to a full purple. This confirmed my suspicion that it



That the chalybeat principle not only abounds in this water, but is besides so very refined and delicate as to pass the filtre along with the salt, and be intimately combined with it, in the manner of a martial vitriol, is I humbly apprehend, set above a bare conjecture, by the last experiment but one.

And I propose it to the consideration of those who are better versed in theoretic and practical chemistry than I pretend to be, whether from the scent of the water flowing from the pump, from its turning the precipitate pure silver of a blackish purple, and tinging silver infused in it, always yellow, but much more so when it affords evident marks of putrescence; whether, I say, it has not a principle of sulphur in its composition, the acid of which let loose when it begins to putrify, dissolves the separated martial ochre, and renders it fit to be taken up again into the aqueous fluid? And, whether that which is commonly understood by the terms, ethereal fugitive spirit, *spiritus rector mineralis*, &c. should be admitted as

had been prevented from growing vapid, by the addition of an acid, and made me recollect that Mr. REYNOLDS is very clear, that so volatile a water as the Pyrmont is represented to be, cannot retain its tinging faculty, even for a few days, but by mixing acids with it; and he appears to confirm what he advances by strong arguments. See his sensible treatise on the Bromley chalybeat, pag. 26, 27, 28. And Dr. HALES, Experiments and Observations, pag. 124, tells us, that the Pyrmont waters often here have seemed very brisk from their brisk air, yet would give no tincture with galls, nor was any benefit found from drinking them.

4. After a very gentle evaporation in *balneo vaporis*, I had  $39\frac{1}{2}$  grains of residuum from a quart of this Pyrmont water, or 158 grains on a gallon, being somewhat more than what Dr. RUTTY states: of those  $39\frac{1}{2}$  grains 22 were an impalpable calcareous earth of the colour of rotten stone, and  $17\frac{1}{2}$  a dissoluble bitter salt. Dr. SEIP found 22 grains of calcareous matter in a pound of the water, 7 of which were a bitter salt.

a component principle of chalybeat waters, or considered only as a mode of acting of certain real principles upon one another?

Upon the whole, then, I think I may conclude from this second series of experiments, that the component parts of the Bagnigge chalybeat, are,

1. A pure elemental water.
2. An elastic air.
3. A calcarious absorbent lime-stony earth.
4. A small portion of selenite.
5. An ochreous earth.
6. A highly attenuated iron.
7. A muriatic salt.
8. A little bitter neutral salt.
9. And probably an active sulphur.

*Of the medicinal virtues of the chalybeat water, with directions for using it.*

Although experience abundantly proves, that the operation of chalybeat waters in general, as evacuants, is by urine; yet it is as constantly observed, that they are apt to prove a little purgative at first drinking of them, especially if they happen to have any thing of a bitter salt in them, as this of Bagnigge very evidently has; whence three or four glasses of it are apt to take downward at the first setting out; but this effect seldom lasts longer than whilst it is clearing away the vitiated contents of the primæ viæ; such as produce bitter, fower and greasy belchings, with distentions and flatules of the stomach.

It dilutes and dissolves vicious humours, obtunds and corrects acrimonious and bilious ones, and temperates acidities and inordinate fermentations; re-

H

strains



strains effervescences of the blood, and recreates the spirits beyond any other medicines.

It greatly increases the momentum of the blood without heating it, and thereby proves an excellent deobstruent in glandular infarctions and obstructions; conquers scrophulous disorders in young people, by mending the weak tone in the solids, and acting as an aperient, resolvent, and a detergent; as a sharpener of the appetite and a strengthener of digestion.

It is so mild as seldom to disagree with the most delicate constitutions, such as can by no means endure any of the officinal preparations of steel; hence it is excellent in all hypochondriac and hysterical complaints, and nervous diseases; attenuating the circulating fluids and invigorating the solids, removing the green sickness and the whole train of troublesome symptoms, which so frequently precede the first eruption of the catamænia.

In disorders of the breast, habitual coughs and asthmas, it is of surprizing efficacy, provided there be no spitting of blood, fierce hectic heat, or ulceration of the lungs; but in the first stages of consumptions arising from a strumous habit, as they oftener perhaps do than from any other cause in northern climes, a cure may be very reasonably expected from a timely use of this water.

By its corroborating and braceing qualities it proves very strengthening and beneficial to the intestines and lacteals, spleen, and liver; its efficacy in stopping beginning dropries and restoring the tone of the lymphatics, may be depended upon, as also for restraining inordinate fluxes of the menses, dysenteries, and the fluor albus. Dr. Jurin in his letter to Dr. Hales greatly commends the use of chalybeats lightly acidulated, in the diabetes, for which disorder

der Dr. Slare prefers them to the Bristol water ; but it will be proper to begin with the purging spring for a few days.

Our chalybeat has done remarkable service in ulcers of the kidneys, and in bringing away gravel when obstinately fixed, and stones of the bladder ; but before it is ventured upon in these complaints, it will be highly necessary to be satisfied that the stone is not too large to pass the urethra.

After continual fevers, and to prevent the return of agues, nothing may be more safely relied upon, if assisted with stomachic bitters.

From what has been said this chalybeat cannot fail (if taken under the direction of an intelligent physician, which may be absolutely necessary in many circumstances) of removing cachexies, jaundices, atrophies from infarctions of the mesentery, irregularities and suppressions of the menses, as well as excessive fluxes of them and of the hæmorrhoidal veins, and in general all disorders arising from viscosity or acrimony of the juices, whether in the primæ viæ or elsewhere, obstructions, inordinate effervescence of the blood, relaxations, want of natural heat, nervous debilities, and fizy and acrimonious humours, particularly irregular gout and scorbutic rheumatisms.

*Directions to be observed in the use of the chalybeat water.*

In plethoric constitutions and suppressed menses, bleeding to a moderate quantity will be properly premised ; and if the stomach and intestines are clogged with viscidities it will be best to take a vomit in the evening, and the next morning three glasses of the purging water ; and the following day begin



with a single glass of the chalybeat, which may be increased, a glass a day, to four glasses, or five if it fits well on the stomach, and passes off easily, whether by stool or urine, and close the course with the purging water.

In scrophulous, rheumatic and scorbutic complaints, also in costive habits, the purging water may be mixed with the chalybeat, or each drank alternately day by day ; and the like in the stone and gravel.

If the chalybeat fits ill on the stomach at first, swallowing caraway seeds, or dropping in a little tincture of cardamoms will reconcile it.

In cold weak stomachs the water may be made milk-warm without impairing its virtue.

Use exercise between the glasses, but not to raise a sweat, and avoid crude and flatulent diet through the whole course of drinking.

To conclude, (in the words of Mr. REYNOLDS)  
 “ we cannot but reflect, with adoration, on the  
 “ goodness of that PROVIDENCE, whose mercy is  
 “ over all his works ; who, in compassion to our  
 “ bodily infirmities, has bountifully supplied us with  
 “ those salutary fountains in the neighbourhood of  
 “ this great metropolis.”

# APPENDIX.

**A**LTHOUGH the probable effects of mineral waters in particular disorders may be rationally inferred, when their constituent principles are once well understood ; yet as real facts are ever most convincing and satisfactory, I thought it not amiss to annex a few cases wherein these springs have proved of signal benefit. They are all taken from accounts given either by the persons themselves, or their intimate friends, excepting one or two, which I relate upon my own knowledge.

Mr. PEREGRINE PHILLIPS, an officer in the royal navy, being a long while stationed in America in the late war, contracted a most violent scorbutic disorder, so obstinate as not to give way to any medicines that were prescribed to him by his physicians for years together : he was frequently covered over with cuticular eruptions, mostly dry, though sometimes with moist sores, by which he found himself more relieved than by all the remedies he had used ; for when his skin was clearest and his sores dried up, he was tormented with such inward heats, pains of the stomach and insuperable costiveness, that he wished himself dead. As he imagined that his complaints arose from a cold cause, he was reluctant to try what waters would do for him, tho' advised to it by some of his friends. At length hearing what the Bagnigge waters had done in cutaneous foulnesses, he determined to go into a course of drinking them, and accordingly began with the chalybeat; but finding after a few days use, that this water rather increased his costiveness, tho' it mended his appetite, he took to the purging water for some days, and afterwards drank them



them both mixed. When he began, his most alarming symptom was broad livid spots on his legs and thighs, which were also thick and of a callous hardness, so that a surgeon he consulted apprehended a mortification would ensue. However, in a week or ten days, he found them softened, and soon after they became scurfy and peeled off; his appetite returned as his costiveness abated, his former pains and heats vanished, and his constitution by the end of the summer season of 1758 seemed quite renewed. However, at the beginning of 1759, he found there were some relicks still to be eradicated, and had recourse to the wells again early in the spring, and soon found himself set to rights again, and has continued well ever since. Nevertheless he is determined to drink the water once a year as long as his residence in London will allow him, for the sake of the fresh spirits and keen appetite they never fail to create.

A Lady at about the age of fifty, begun to be troubled with a difficulty of breathing, had several times been at Tunbridge, and always found benefit; she having heard of Bagnigge Wells, consulted her physician, whether a course of those waters might be entered upon with any hopes of success? He was not against her trying them, and as she lived not a great way from the wells she was determined to do it: this was the spring of 1759, at which time it was with great difficulty that she could get in or out of her chariot, and was unable to walk up one pair of stairs, without resting some minutes at the first landing place, before she could proceed further; her appetite was wholly gone, she was much emaciated, begun to be dropfical, and her skin was tinged yellow all over. In this condition she visited the wells, and began with a single small glass of the chalybeat; the

next

next day she took two, afterwards three, adding a tea spoonful of the tincture of cardamoms to the first glass for some time. She continued the course for nine and forty mornings without interruption, at the end of which she found herself relieved, and free from her complaints. This relation I had from her husband, the lady herself being walked abroad upon a visit, tho' in very cold weather. He told me himself, and all their acquaintance could not but look upon this as an extraordinary cure : and to confirm the above account, desired I would call again, which I did, and had the same relation from the lady herself.

Mr. DAVIS, master of the academy at Islington, was many years troubled with weak and inflamed eyes, and a hard and thick swelling of his upper lip, which was sometimes so enlarged as to lye almost even with his nose, being covered with sore eruptions. He drank the purging waters at the proper season in 1757, and found that they never failed to work in the mildest manner, though sufficiently, and without the least griping or offence to his stomach. He perceived his lip to contract in size in a very short time, and the disorder in his eyes, which plainly appears to have been a scrophulous ophthalmia, sensibly to abate : so that by the end of the season he had no remains of his disorder, but thought it best to renew his course the next season to confirm his cure. He has so good an opinion of this purging water, that he takes the young gentlemen under his tuition to drink it twice a year at the proper seasons.

Mr. CADWELL, shoemaker, at the corner of Great Turnstile Holborn, was for many years afflicted with  
a fierce



fierce hot humour that beset most parts of the surface of his body, and was of so acrimonious a condition, that it ran out of the sores of his legs through his stockings: it would raise blisters on his feet as if scalded with boiling water, and if he used any outward applications that repelled it, he felt miserable pains in his stomach, bowels and head. He had taken a world of medicines, besides drinking sea water for a long time to very little or no purpose; at length he drank the purging water at Bagnigge Wells, which soon altered the nature of the humour, his sores became tolerable, and after a few weeks healed, his appetite and sleep returned, and he obtained a perfect cure without any relapse.

Mr. WILLIAM LEACH of the Strand had a very troublesome cutaneous disorder, which was by his apothecary pronounced to be a leprosy, accompanied with inward heat, frequent and sudden anxieties and restlessness in bed. When he undressed himself handfuls of scales would fall off, and the itching was scarce endurable; in 1757, he went to drink the sea water, and continued it the whole season without visible amendment. In 1758, he began with this purging water, and drank it every day; sometimes three or four glasses as a purge, at others one or two, as an alterative, in which course he persisted two months, which quite conquered the complaint, and his skin is now as clear as it ever was in his whole life.

Mr. TRING, gardener near Old Street, was for eight or nine years afflicted with a very painful disorder, which every one that he had consulted took for a rheumatism, or lumbago dorsalis: all medicines that he took rather aggravated than assuaged his pains, which at last seemed fixed altogether to his  
loins,

loins, so that he could not follow his business, nor even raise himself without help when he was seated. He was willing to try what the Bagnigge waters would do, and first begun with the purging spring, but soon changed that for the chalybeat, which not only soon was the means of informing him what his real disorder was, but likewise afforded him speedy relief; for he voided daily amazing quantities of gravel, and thick gelatinous slime, and as he did so, perceived a proportionable abatement of his pains, and in a few weeks became perfectly easy, acquired a good appetite and digestion, and found himself improved in his constitution, and fixed in such a state of health as he had not known for many years.

Mr. MILLS, master taylor over against St. Dunstan's church Fleetstreet, was troubled with much the same kind of pains as Mr. TRING in the case last related, and withal had a frequent provocation to urine, but could void little at a time, and that followed with great uneasiness about the neck of the bladder, which he took for the strangury. He had taken various medicines from his apothecary, but found no manner of benefit. After all he drank the purging waters, which at first answered no otherwise he said, than making him chearful and giving him a good appetite, which therefore induced him to continue them. At length he perceived a very acute pain as he was making water, which suddenly stopped the stream; but upon another effort the urine issued and he heard something fall into the chamber-pot, which proved to be a stone, and the next day but one he voided another. These stones he shewed me; they were then of the size and shape of a  
I
scarlet



scarlet bean, but were at first much bigger. He continued this water to the end of the season, and has been well ever since.

Captain J----h Br----s had been troubled with a very obstinate gleet from a wrong treatment of a virulent gonorrhea, which rather increased than abated after three years use of internal and topical remedies, besides the cold bath. During the five or six last months, the oozing liquid was as colourless as gum water, and almost as thin; whence it was apprehended that the ostiolæ of the urethral lacunæ were consumed, and his case was looked upon as incurable. In March 1759, he began drinking the Bagnigge chalybeat; in less than three weeks he perceived the running much decreased, and by the end of May disappeared entirely. He persisted in his course through the rest of the season, and has never since, as he very lately assured me, been troubled with the least return of his disorder, but enjoys such a constant health and flow of spirits, as he was a stranger to for many years before.

Mrs. M A R Y W E S T, hatter of Monmouth street, contracted from a surfeit, a most severe cutaneous disorder, wherewith her face was chiefly affected, being swoln to a monstrous degree, so as in appearance to resemble an erysipelas, but without any of the symptoms commonly previous to that disease, as shivering, prostration of strength, &c. or any concomitant fever. This tumor was attended with intolerable itching, and in a short time threw off abundance of white scales like the leprosy, which were constantly renewed. After taking purges, and other shop medicines, with liniments, without benefit, she

she had recourse to the purging waters at Bagnigge; which she had scarce used three mornings before the swelling quite subsided, the branny scurf wasted, and her natural complexion gradually returned in so short a time, that it was surprising both to herself and her neighbours.

ELIZABETH DEANE of Deptford, widow, aged fifty-five, about four years ago first felt in her left breast a small moveable hard knot, as she called it, of the size of a hazle nut, which continued much the same twelve or fourteen months with little or no pain. It appears, that this was an occult cancer; for on a sudden its bulk increased, and it grew enormously larger and larger, with frequent and intolerable darting pains. About a year and a half ago, it was perceived to be fixed at the bottom, and soon after was knotty and uneven towards the surface, and looked of a livid complexion under the skin, which made the poor woman apprehend it would in time corrode and eat its way through. A relation who lived at Kentish-town, telling her that she had received great benefit from the Bagnigge purging water in a hard tumor of her breast, Mrs. DEANE was willing to try it, and prevailed upon her brother to fetch her a large stone bottle of it once a week. She drank at the rate of a quart, and sometimes three half pints a day, which kept her body just open. In less than a fortnight the shooting pains were at an end, and in six weeks the tumor was much reduced. In September last it became loose again, as it continues at present, being now scarce half so big as a chesnut, giving her little or no uneasiness, except some times upon taking  
I 2 cold,



cold, and then two or three pints of the water never fail to relieve her.

Mrs. MILLS, wife of the above mentioned Mr. MILLS, was for a good while together troubled with an habitual vomiting, and also at times with pains of the stomach, and a total loss of appetite. It was very rare that she could retain what she eat at dinner, longer than an hour or two. As she frequently accompanied her husband to the wells, by his persuasion she drank the purging waters along with him : and in a little time her vomitings and stomach pains left her, the appetite was restored, and she is now able to eat and digest more in one day, than she had usually done in a week.

A Clergyman near town, upon the interruption of the accustomed return of a fit of the gout, fell into a hypochondriac melancholy, for which he was advised to take Dr. LOWER's bitter infusion with steel, and exercise himself every day on horseback. He kept to this regimen several months, without any apparent benefit. Afterwards he drank of a chalybeat spaw in the spring 1758, and repeated it at intervals most part of the summer, with no better success. The last year he began with the Bagnigge purging water, and took three half pints every other morning for three times, which wrought easily, and without fluttering his spirits in the least : then he took to the chalybeat, beginning with two half pint glasses each morning, which in a few days he increased to four, but never exceeded that quantity. At a month's end he was so well reconciled to his medicine, that he proposed

posed to continue it through the summer season, but was admonished by his physician to desist. He continued the whole autumn and winter in good spirits, and slept well. Soon after Christmas this year, a fit of the gout returned, which proved a pretty smart one, but of moderate duration; and he now finds himself in better health than he has enjoyed for several years past.

*F I N I S.*





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